TRANSFERRING OF A MESSAGE

FIELD OF THE INVENTION

5   The present invention relates to a messaging service. In particular, but not necessarily, the invention relates to the store-and-forward messaging of multimedia messages in a wireless telecommunication system.

BACKGROUND OF THE INVENTION

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Wireless communication networks and the Internet network are expanding rapidly and their number of users is increasing. The GPRS (General Packet Radio Service) of the GSM (Global System for Mobile Communications) provides means for transferring information in packet switched mode in a cellular radio network.

15   GPRS also provides an interface to other packet switched networks, such as the Internet network.

Figure 1 shows the interconnections of a telecommunication network in a packet switched GPRS service. The main element of the network's infrastructure for

20   providing GPRS services is a GPRS support node. GPRS support nodes are categorised into Serving GPRS Support Nodes SGSN which, in packet switched data transmission correspond to the Mobile Switching Centers MSC of the GSM network, known in connection with circuit switched data transmission, and Gateway GPRS Support Nodes GGSN. An SGSN is a support node that transmits

25   data packets to a wireless terminal MS (Mobile Station) and receives data packets transmitted by a wireless terminal through a Base Station System BSS, comprising base transceiver stations BTS and base station controllers BSC. In this description, the term wireless terminal MS is used to mean all terminals that communicate over a specific radio interface. Thus, a computer terminal that

30   communicates through a mobile station attached thereto will also be referred to as a wireless terminal. The SGSN also maintains information on the location of the wireless terminals that move in its service area in GPRS registers (not shown in Figure 1). Physically, the SGSN is typically implemented as a separate network element. The GGSN that communicates with the SGSN provides a connection to

35   and enables co-operation with other networks. Such networks can be, among others, another operator's GPRS (cellular) network or a private network such as, for example, a company's Intranet network , a public switched packet data network PSPDN such as, for example, the Internet network or an X.25 network.

For a long time, the user of a computer terminal in communication with the
Internet network has had the opportunity to retrieve multimedia components, such
as pictures, text, short video clips and audio clips in electronic format, into his
computer terminal from a server of the Internet network. As data transfer rates
5   increase and the properties of mobile stations improve, an interest in a multimedia
messaging service and messaging services in general has now also been
awakened in wireless networks. As networks that support packet switched data
transmission, the GPRS network and 3rd generation mobile communication
networks, such as CDMA2000 (Code Division Multiple Access) and WCDMA
10   (Wideband CDMA) in particular, are very well suited for the implementation of a
multimedia messaging service.

A multimedia messaging service for 3rd generation mobile communication
networks has been proposed which would be implemented in a manner similar to
15   the Short Message Service SMS in a GSM network, i.e. substantially in a store-
and-forward manner by transferring messages addressed to a wireless terminal,
stored in a specific messaging server, to the wireless terminal when it can be
contacted. Said messaging server would preferably be located outside the cellular
network in question, for example, in the Internet network.
20   In the following, a GPRS network will be examined. In the GPRS service of the
GSM network, a wireless terminal "attached" to the GPRS network can transmit
and receive short messages. The wireless terminal can transmit and receive data
in packet switched mode if it is attached to the GPRS network and, in addition, it
has an active PDP-context (PDP = Packet Data Protocol) with some GGSN.
25   Activation of a PDP-context may be effected either at the request of the wireless
terminal or the network.

It is expedient for the messaging server to make specific inquiries to the GPRS
network from time to time. For example, on receiving a message addressed to a
30   given wireless terminal, it is expedient for the messaging server to make sure, by
making an inquiry, that the wireless terminal in question is actually ready to
receive the message (i.e. it has an active PDP-context with some GGSN), before
transmitting the message to the GPRS network . In cellular networks, dynamic
PDP addresses (such as dynamic IP addresses, Internet Protocol) are often
35   allocated to terminals. In this case, a wireless terminal does not necessarily
always have use of the same PDP address, but when a wireless terminal requests
a PDP address, the network gives it a PDP address, which may be the same PDP
address the wireless terminal had on a previous occassion, or some other PDP

address, depending on what PDP addresses the network has free at that time for the use of wireless terminals.

When using dynamic IP addresses there is a problem associated with performing the previously mentioned inquiry to identify said wireless terminal from outside the cellular network (GPRS network): How can a wireless terminal be identified from outside a cellular network so that inquiries relating to the wireless terminal can also be carried out reliably when the wireless terminal has a dynamic PDP address?

SUMMARY OF THE INVENTION

Now, a new solution has been invented relating to the identification of a wireless terminal. According to a first aspect of the invention, there is provided a method for inquiring about information relating to a terminal of a cellular network from the cellular network, from a messaging server external to the cellular network. The method is characterised in that it comprises:

sending an inquiry from the messaging server to the cellular network to determine said information relating to the wireless terminal, the inquiry comprising a first identifier for identifying said terminal, the first identifier being a specific identifier external to the cellular network;

mapping said first identifier to a specific second identifier in the cellular network, the second identifier being an internal identifier of the cellular network;

determining said information relating to the terminal with the aid of said second identifier;

sending a response message in response to said inquiry from the cellular network to said messaging server external to the cellular network , in which response message said information relating to the terminal is indicated with the aid of said first identifier.

According to a second aspect of the invention, there is provided a server external to a cellular network for inquiring about specific information relating to a terminal of the cellular network from the cellular network ·

The server is characterised in that it server comprises:

means for defining a specific first identifier external to the cellular network for identifying said terminal;

means for sending an inquiry from the server to the cellular network to determine said information relating to the terminal, the inquiry comprising said first identifier.

According to a third aspect of the invention, there is provided a computer program product executable in a server external to a cellular network for inquiring about specific information relating to a terminal of the cellular network from the cellular network.

5 The computer program product is characterised in that it comprises program code:
for defining a specific first identifier external to the cellular network for identifying said terminal;
for causing said server to send an inquiry to the cellular network to determine said information relating to the terminal, the inquiry comprising said first identifier for
10 identifying said terminal.

According to a fourth aspect of the invention, there is provided a network element of a cellular network.
The network element is characterise in that it comprises:
15 means for receiving a specific inquiry sent by a server external to the cellular network, the inquiry comprising a request to determine specific information relating to a terminal of the cellular network, and the inquiry comprising a first identifier for identifying said terminal, the first identifier being a specific identifier external the cellular network;
20 means for mapping said first identifier to a specific second identifier, the second identifier being an internal identifier of the cellular network;
means for determining said information relating to the terminal with the aid of said second identifier;
means for sending a response message to the server external to the cellular
25 network in response to said inquiry, the response message comprising the information relating to said terminal indicated with the aid of said first identifier.

According to a fifth aspect of the invention, there is provided a computer program product executable in a network element of a cellular network.
30 The computer program product is characterised in that it comprises program code:
for causing the network element to receive a specific inquiry sent by a server external to the cellular network, the inquiry comprising a request to determine specific information relating to a terminal of the cellular network, and the inquiry comprising a first identifier for identifying said terminal, the first identifier being a
35 specific identifier external to the cellular network;
for mapping said first identifier to a specific second identifier, the second identifier being an internal identifier of the cellular network;
for causing the network element to determine said information relating to the terminal with the aid of said second identifier;

for causing the network element to send a response message to the server external to the cellular network in response to said inquiry, the response message comprising the information relating to said terminal indicated with the aid of said first identifier.

According to a sixth aspect of the invention, there is provided a system, comprising a server external to a cellular network and a network element of the cellular network for inquiring about information relating to a terminal of the cellular network from the cellular network, from the server external to the cellular network. The system is characterised in that the server comprises:

means for defining a specific first identifier external to the cellular network for identifying said terminal;

means for sending an inquiry from the server to the network element of the cellular network to determine said information relating to the terminal, the inquiry comprising said first identifier, and that the network element of the cellular network comprises:

means for receiving said inquiry;

means for mapping said first identifier to a specific second identifier, the second identifier being an internal identifier of the cellular network;

means for determining said information relating to the terminal with the aid of said second identifier;

means for sending a response message to the server external to the cellular network in response to said inquiry, the response message comprising the information relating to said terminal indicated with the aid of said first identifier.

In this description, the terminal can be any wireless terminal that can be attached to a GPRS network or a 3rd generation network, for example, a mobile station of a cellular network or a computer terminal attached to a GPRS network (e.g. through a telephone of a cellular network). In connection with the present application, the concept of a cellular network should be interpreted broadly , whereupon the concept of a cellular network is also considered to cover, for example, the GPRS service of a GSM network and the network elements of the core network of a 3rd generation network. In a preferred embodiment of the invention, said server is a messaging server, even more preferably a multimedia messaging server, located outside the cellular network in a packet data network, such as the Intranet network of an operator, the Internet network or an X.25 network.

In a preferred embodiment of the invention, said inquiry sent from the server to the cellular network to inquire about information relating to the terminal of the cellular

network is addressed to a specific network element of a GPRS network, to a GGSN, which determines said information relating to the terminal of the cellular network, which can be, e.g. whether the terminal is attached to the GPRS network or whether the terminal is ready to receive data, and indicates it to said server external to the cellular network.

A specific first identifier external to the cellular network is used to identify the terminal between the server and the cellular network which, in connection with apreferred embodiment of the invention, is called an MMS-ID. Said first identifier is mapped to a specific second identifier in the cellular network. Said second identifier, which is an internal identifier of the cellular network and which can be, for example, the terminal's IMSI (International Mobile Subscriber Identity) code or an equivalent, is used to identify the terminal inside the cellular network and it is not revealed to network elements external to the cellular network.

BRIEF DESCRIPTION OF THE DRAWINGS

In the following, the invention will be described in detail with reference to the accompanying drawings, in which

Figure 1   shows the interconnections of a telecommunication network in a packet switched GPRS service;

Figure 2   illustrates an arrangement for implementing message transmission according to the invention;

Figure 3   is a flow diagram illustrating a method for implementing a messaging service according to the invention; and

Figure 4   is a message diagram showing the flow of messages in a method according to the invention;

Figure 5   is a block diagram illustrating functional blocks of an MMSC; and

Figure 6   is a block diagram illustrating functional blocks of a GGSN.

DETAILED DESCRIPTION

Figure 1 was described above in connection with the description of prior art. Figure 2 illustrates an arrangement according to a first preferred embodiment of the invention for implementing message transmission between a wireless terminal MS that supports GPRS and a messaging server. Figure 2 shows a wireless terminal MS, a Base Station System BSS, a Serving GPRS Support Node SGSN, and a Gateway GPRS Support Node GGSN, a Gateway GPRS Support Node GGSN₂ located in the mobile communication network PLMN (Public Land Mobile Network) of a second operator, a Packet Data Network PDN, which in a preferred embodiment of the invention is an IP network, a messaging server that is in communication with the IP network which, in a first preferred embodiment of the invention is a Multimedia Messaging Service Centre MMSC, and a Home Location Register HLR that contains the routing information and the GPRS subscription information of the wireless terminal MS. In this description, the term IP network means either an Intranet network managed by a company and/or an operator, or the open public Internet network.

Figure 2 also shows the interfaces between different network elements: a Um interface between the wireless terminal MS and the base station system BSS, a Gb interface between the base station system BSS and the SGSN, a Gn interface between the SGSN and the GGSN, a Gi interface between the GGSN and the IP network, a Gr interface between the SGSN and the home location register HLR, a Gc interface between the GGSN and the home location register HLR, as well as a logical interface 22 according to the invention between the GGSN and the MMSC. In addition, Figure 2 shows a logical Gp interface between the GPRS cellular networks of different operators.

Technically, the GPRS support nodes of a particular operator are connected to each other within the cellular network by the operator's internal IP network (Intra-PLMN Backbone). However, this should not be confused with the previously mentioned Intranet network, which is external to cellular network and is managed by a company and/or an operator. However, said IP networks (the Intra-PLMN Backbone network and the Intranet network managed by the operator) are preferably functionally connected to each other, for example, through a gateway.

By agreement between operators, the GPRS networks of different operators are connected by a GPRS network (Inter-PLMN Backbone) between the operators. In practice, there is typically a firewall and a Border Gateway BG between the Intra-PLMN Backbone network and the Inter-PLMN Backbone network. These are not shown in Figure 2.

Among other things, the purpose of interface 22 is to enable messaging between the MMSC and the GGSN so that the GGSN can process an inquiry coming from the MMSC and respond to it. The MMSC is located outside the cellular network,
5   preferably in the Intranet network of an operator. Preferably the interface 22 is implemented using the same protocol as that used in the operator's Intra-PLMN Backbone network, i.e. an IP protocol. Alternatively, the interface 22 can be implemented using some other protocol of the same level.

10 Figure 3 is a flow diagram illustrating the general outline of a method for implementing a messaging service according to the first preferred embodiment of the invention. The method comprises determining the readiness of the wireless terminal MS to receive data, transferring information about this to an MMSC and, in the case where the wireless terminal MS is ready to receive data, transferring a
15 multimedia message from the MMSC through the GPRS network to the wireless terminal MS.

First, a multimedia message addressed to the wireless terminal arrives at the MMSC and the MMSC stores it in its memory (block 31). Next, the MMSC sends
20 an inquiry to the GGSN through the interface 22, i.e. a messagerequesting information from the GGSN on whether the wireless terminal MS, to which the multimedia message is addressed, is ready to receive data (block 32). According to the invention, a specific identifier MMS-ID external to the cellular network, to be presented later, is used in said inquiry to identify the wireless terminal. In block 33,
25 the GGSN maps said identifier external to the cellular network to a specific internal identifier of the cellular network (IMSI or equivalent). In block 34 the GGSN determines whether the wireless terminal MS is ready to receive data using said internal identifier of the cellular network. In the case of a GPRS network, the GGSN determines whether the wireless terminal has an active PDP-context with
30 some GGSN. If the wireless terminal MS is ready to receive data (a PDP-context is activated with some GGSN), the GGSN sends a positive response message, again comprising said identifier external to the cellular network (block 35a), to the MMSC through the interface 22, after which transfer of the multimedia message from the MMSC to the wireless terminal MS can start (block 36a). If the wireless
35 terminal MS is not ready to receive data (a PDP-context is not activated), the GGSN sends a negative response message comprising said identifier external to the cellular network to the MMSC through the interface 22 (block 35b), whereupon transfer of the multimedia message from the MMSC to the wireless terminal MS cannot be started at that time (36b). This being the case, the inquiry to determine

the readiness of the wireless terminal MS to receive data can be repeated, for example, after a certain period of time (dashed line to block 32).

Said multimedia message may comprise a plurality of multimedia elements, such as pictures, text, short video clips and audio clips in electronic format. The address of the recipient of the multimedia message associated with the multimedia message can be, for example, the telephone number of the wireless terminal MS, the logical network address of a computer terminal attached to the GPRS network or some other address supported by GPRS. Typically, said address is in RFC822 format. RFC822 is an Internet standard that defines a format in which a logical address can be presented in a form understandable to the user. An example of an address in RFC822 format is outi.aho@mmsc1.nokia1.com. Here, "mmsc1.nokia1.com" is the logical address (so-called domain name) of the MMSC in question. The telephone number of a wireless terminal can also be converted into RFC822 format in an IP network. URL (Uniform Resource Locator) pointers can also be attached to said multimedia message.

Typically, the MMSC always sends the inquiry related to the readiness of said wireless terminal MS to receive data to the same GGSN, which will be called a "default-GGSN" from now on. The address of the default-GGSN (typically indicated as a logical domain name which can be, e.g. in the form ggsn1.nokia1.com) is stored in the MMSC. The MMSC is located in a packet data network. Preferably, the MMSC is located outside the GPRS cellular network in the IP network (Intranet network) of the operator that also manages said default-GGSN. Alternatively, the MMSC can be managed by an external service provider, for example, in the Internet network.

The address of the recipient of the multimedia message in plain RFC822 format, stored in the MMSC, is mapped in the MMSC to a specific identifier, external to the cellular network, which is then used as an identifier for the wireless terminal MS in communication between the default-GGSN and the MMSC. In this description, said external identifier is called an MMS-ID (Multimedia Messaging Service IDentity). To perform the mapping, the MMSC comprises a specific database, in which the wireless terminal's multimedia messaging service subscription information is stored. The correspondences between the MMS-ID and the the wireless terminal's addresses in RFC822 format are also stored in said database. Said database of the MMSC is presented in connection with the description of Figure 5.

The MMS-ID is an identifier external to the of the cellular network, a parameter or a set of parameters, which indicates the MMSC from which the wireless terminal MS in question (the owner of the terminal) has subscribed to a multimedia messaging service. The MMS-ID has a general data format, so it can be, for example, in a text format and, for example, may appear as follows:

I MMSC ID I User ID I Security ID I ,

where a vertical line (I) separates the different parts of the MMS-ID, which are for example, an MMSC ID, which is the identifier of the MMSC in question, a User ID, which is the identifier of the (multimedia messaging) service subscriber, and a Security ID, which can be formed in the MMSC and the default-GGSN on the basis of the MMSC ID and the User ID using a specific algorithm agreed upon in advance. The Security ID can be used in the cellular network to ensure the legitimacy of the MMSC and the subscriber.

The correspondence between the MMS-ID and the IMSI code of the wireless terminal in question, which is an identifier internal to the cellular network, is stored in the GPRS network. The database in which it is stored, can be implemented in the GPRS network, for example, by means of a DNS (Domain Name System) server. The IMSI code is used as the principal identifier of the mobile subscriber of the wireless terminal MS within the GPRS network. Typically, the IMSI code is stored in a SIM (Subscriber Identity Module) card. The SIM card is used as a subscriber identity unit in the wireless terminal MS. Thus, when the present description refers to e.g. the IMSI code of a wireless terminal, this means the IMSI code of a subscriber known to the network, stored in a SIM card or the like, installed in the wireless terminal MS. Correspondingly, when a multimedia message addressed to the wireless terminal MS is mentioned, this means a multimedia message addressed to the subscriber whose SIM card is in the wireless terminal MS, and so on.

Depending on the implementation, the database in which the correspondences between the MMS-ID and the IMSI code of the wireless terminal are stored may be located in different places in the teleoperator's GPRS network. The database should be easy for the default-GGSN to access. Said database can also be implemented in an appropriate manner by means other than a DNS server. It is also possible to integrate said database into the HLR, but preferably this is not

done, as there is a desire to keep the amount of data to be stored in the HLR as small as possible.

Figure 4 shows a message diagram that illustrates the flow of messages between
5   the MMSC and the parts of the GPRS network in a first preferred embodiment of the invention. Having mapped the address of the recipient into an MMS-ID, the MMSC sends an inquiry, in the form of a Client Identification Request message 41, to the default-GGSN to determine the readiness of the wireless terminal to receive data. The MMS-ID is delivered with this message. After this, specific
10   authentication and security functions 42 can be carried out to check that the MMSC in question is authorised to carry out said inquiry. Typically, the Security ID part of the MMS-ID is used here, in such a way that the default-GGSN forms a Security ID on the basis of the MMSC-ID and User ID comprised by the MMS-ID using a specific pre-determined algorithm and compares it to the Security ID
15   (formed by the MMSC) delivered with the MMS-ID. Alternatively, some other security mechanism can be used.

The default-GGSN maps the MMS-ID delivered with the Client Identification Request message 41 to the IMSI code of the wireless terminal to which the MMS-ID in question belongs. The default-GGSN preforms said mapping by inquiring
20   about the IMSI code that corresponds to said MMS-ID from the above-mentioned database, in which the correspondences between the MMS-ID and the IMSI code of the wireless terminal are stored (e.g. from the DNS server).

25   Next, the default-GGSN, which maintains the PDP-context parameters and fields (e.g. IP address) of wireless terminals, examines whether the wireless terminal having the IMSI code in question has an active PDP-context with the default-GGSN in question. If a PDP-context is active, the default-GGSN knows that the wireless terminal MS is ready to receive data. This being the case, the default-
30   GGSN is also aware of the wireless terminal's IP address, regardless of whether it is statically or dynamically allocated. As a response to the inquiry, the default-GGSN now sends the MMSC a positive Client Identification Response message 47, which indicates that the wireless terminal MS having the MMS-ID in question is ready to receive data. It is possible to indicate the IP address (either dynamic or
35   static) of the wireless terminal that is ready to receive data in said positive Client Identification Response message 47, or just to indicate that the wireless terminal MS having the MMS-ID in question is ready to receive data through the default-GGSN in question.

If the MMSC is logically connected with the GPRS (cellular) network, for example, in the operator's own Intranet network, interface 22 can subsequently be used for transmitting the multimedia message to the default-GGSN (and further to the wireless terminal MS). If the MMSC is located in a packet data network (e.g. in the Internet network) managed by an external service provider, typically, the multimedia message is also sent to the MS through the Internet network. According to the invention, the multimedia message is preferably no longer stored in any network element of the cellular network, but the data packets are delivered uninterrupted to the wireless terminal MS. This advantage is achieved by placing the MMSC outside the cellular network. Transmission of data from the packet data network to the GPRS network is well known to a person skilled in the art.

If the wireless terminal MS does not have an active PDP-context with the default-GGSN, the default-GGSN determines whether the wireless terminal MS has an active PDP-context (an existing data connection) with some other GGSN. Preferably, the default-GGSN finds this out by making an inquiry in the form of a PDU Info Request message 43 (PDU = Protocol Data Unit) over the Gc interface to the home location register HLR. Alternatively, if the Gc interface is not implemented in the system, the GGSN can send a PDU Info Request message 43' over the Gn interface to the SGSN and request the SGSN to transfer the message 43' over the Gr interface to the HLR.

Here it should be noted that the PDU Info Request message 43, 43' does not have to be transmitted at all if the wireless terminal MS has an active PDP-context with the default-GGSN, i.e. with the GGSN to which the Client Identification Request message 41 was originally sent from the MMSC. Therefore, the PDU Info Request message 43, 43' and the PDU Info Response message 44, 44' sent in due course as a response, are shown with dashed lines in Figure 4.

The HLR maintains the GPRS subscriber information of wireless terminals. Among other things, information on the PDP-contexts a wireless terminal having a specific IMSI code is permitted to activate is found in the HLR's "PDP context subscription records" fields. The "PDP context subscription records" fields also comprise an "Access Point Name" field (APN) that indicates, for each IMSI, the Access Points at which a particular wireless terminal MS is permitted to connect to an external packet data network. Here the term external packet data network means the Internet network, for example. On receiving the PDU Info Request message 43, 43', in the next step of the method the HLR checks the logical names of the access points permitted to the IMSI in question from the APN field,

on the basis of the IMSI code of the wireless terminal MS in question sent with the PDU Info Request message 43, 43',

Said logical names of the access points are sent by the HLR to the default-GGSN in a PDU Info Response message 44, 44'. The PDU Info Response message is sent from the HLR to the default-GGSN, either directly through the Gc interface (message 44) or via the SGSN over the Gr and Gn interfaces (message 44'). The access point names indicate the GGSNs, with which the wireless terminal MS can have an active PDP-context, to the default-GGSN. A PDP-context can be activated, for example, with another GGSN of the same GPRS network or with a GGSN of a GPRS network (other PLMN) controlled by another teleoperator, such as $GGSN_2$ (Figure 2).

In the next step, the default-GGSN to which the original inquiry from the MMSC arrived, determines if any of the GGSNs with which, on the basis of the PDU Info Response message, the wireless terminal MS may have a PDP-context activated, actually has an active context. This investigation is made by sending said GGSNs a message 45 (Other GGSN, Figure 4), which forwards the IMSI code of the wireless terminal in question and requests each GGSN to examine its own PDP-context fields on the basis of said IMSI code to determine whether the wireless terminal in question has an active PDP-context with the GGSN in question. GGSNs controlled by the same operator are interconnected by the operator's internal IP network (Intra-PLMN Backbone network), whereupon the domain name of each GGSN can be used as the address of the recipient of the investigation message 45. Investigation messages 45 can be sent to the GGSNs of another operator through the Gp interface between different operators, defined in GPRS, or over the Internet via the Gi interface. However, the Gi interface is preferably not used because, for security reasons, there is a desire not to reveal the secret IMSI code of the wireless terminal to network elements external to the GPRS network. Each GGSN to which said message is sent, responds 46 to the default-GGSN that sent the message 45, indicating whether the GGSN in question has an active PDP-context with the wireless terminal MS having the IMSI code in question. In the case where a particular GGSN has an active PDP-context with the wireless terminal MS in question, the response message preferably comprises the PDP address (e.g. IP address) of the wireless terminal in question, particularly if it is of the dynamic type. Said information is apparent from the values of the wireless terminal's PDP-context parameters, maintained by the GGSN in question.

On receiving the responses 46, the default-GGSN sends either a positive or negative Client Identification Response message 47 over interface 22 to the

MMSC. A positive Client Identification Response message 47 comprises information that the wireless terminal having the MMS-ID in question is ready to receive data via a specific GGSN. Preferably, the message 47 contains the MMS-ID in question. Said specific GGSN is the GGSN with which the wireless terminal 5 MS has an active PDP-context. If the wireless terminal has active PDP-contexts with more than one GGSN, the addresses of all these GGSNs can be comunicated to the MMSC. It is also possible to indicate the PDP address, such as the IP address, of the wireless terminal ready to receive data in said positive Client Identification message 47.

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A negative Client Identification Response message 47 comprises information that the wireless terminal having the MMS-ID in question is not ready to receive data, whereupon the MMSC can, for example, send a new inquiry to the default-GGSN to determine the readiness of the wireless terminal MS to receive data, a specific 15 period of time after sending the previous inquiry.

Alternatively, the default-GGSN can check the wireless terminal's readiness to receive data by sending a slightly modified PDU Info Request message 43, 43' to the HLR. In this case, the HLR first looks up the address of the SGSN serving the 20 wireless terminal at that particular moment, from the SGSN Address field maintained in the HLR, and then inquires from the SGSN in question on the basis of the IMSI code of the wireless terminal, over the Gr interface, whether the wireless terminal MS in question has an active PDP-context with some GGSN. The GGSN with which the wireless terminal MS has activated a PDP-context is 25 apparent, e.g. from the value of the "GGSN Address in use" parameter maintained by the SGSN in question. On receiving the information it requested from the SGSN, the HLR further sends a PDU Info Response message 44, 44' to the default-GGSN, as described above. It is also possible that the HLR delivers the address of the SGSN serving the wireless terminal MS to the default-GGSN, after 30 which the default-GGSN inquires about the address of the GGSN with which the wireless terminal MS has an active PDP-context from said SGSN, on the basis of the IMSI code.

According to the invention, a GGSN may also refuse to transfer a message from 35 the MMSC to the wireless terminal. For example, if the wireless terminal's telephone bills have not been paid, the default-GGSN may return a negative Client Identification Response message 47 to the MMSC, in which it is indicated that multimedia messaging to the wireless terminal MS in question is not permitted. Naturally, in this case, the database which maintains the wireless terminal's

invoicing data in the GPRS network must be accessible to the default-GGSN. Typically, said negative Client Identification Response message 47 is also sent in a situation, where the above-mentioned authentication and security functions 42 do not succeed. In this case, execution of the method according to the invention will also be halted in the cellular network before the MMS-ID is mapped to the IMSI.

After receiving a positive Client Identification Response message 47, the MMSC sends the multimedia message as data packets to the GGSN with which the wireless terminal has an active PDP-context. Said GGSN forwards the data packets to the wireless terminal MS.

The MMSC can send the data packets to said GGSN via the default-GGSN or through a packet data network, such as an IP network (e.g. Intranet, Internet). If said GGSN is served by an MMSC different from that which communicated with the default-GGSN, the data packets can alternatively be sent to said GGSN through this second MMSC. IP protocols or other protocols supported by the GPRS network can be used for communication between the MMSC and the wireless terminal MS.

The multimedia message described in connection with the first preferred embodiment of the invention, which the MMSC transfers to the wireless terminal that has subscribed to the multimedia service, may originate from many different sources. It can be, for example, a photograph, fax, home-video clip or voice message sent in electronic format from one wireless terminal to another. It may also contain, for example, an electronic mail message sent from a TCP/IP network to the MMSC, comprising a multimedia component to be transferred to the wireless terminal, or any message comprising multimedia components. Although this description has mainly discussed multimedia messages, the invention is not restricted to a multimedia messaging service, but can be used in any similar messaging service.

Alternatively, a messaging service can be implemented in a pull-type mode. In this case, the messaging server sends the wireless terminal MS a notification message to indicate that a message addressed to the wireless terminal has been stored in its memory. After this, the wireless terminal can decide about retrieving said message from the messaging server to the wireless terminal MS. Said notification message can be transmitted to the wireless terminal MS as a short message (SMS), if it is attached to the GPRS network even if it does not have an

active PDP-context activated with any GGSN. If the wireless terminal MS is, however, attached to the GPRS network (MS is in a GPRS attach mode), it is possible for said notification message, for example, to request the wireless terminal MS to activate a PDP-context to enable it to receive messages (e.g.
5   multimedia messages from a messaging server).

According to a second preferred embodiment of the invention, an inquiry is made from the messaging server to determine whether the wireless terminal is attached to the GPRS network (GPRS attach) in order to know whether the wireless
10   terminal can receive said notification message in the form of a short message. This is done after storing the message addressed to the wireless terminal by sending a slightly modified Client Identification Request message 41 from the MMSC to the default GGSN in which the default-GGSN is requested to determine whether the wireless terminal having the MMS-ID in question is attached to the
15   GPRS network.

The default-GGSN maps the MMS-ID to the IMSI of the wireless terminal in question with the aid of the DNS server and checks whether the wireless terminal is attached to the GPRS network by sending a PDU Info Request message 43, 43'
20   to the HLR. In this case, the HLR checks the SGSN Address field it maintains, according to the IMSI in question, to determine whether the SGSN Address field contains the SGSN address. If the SGSN address is found in the field in question said wireless terminal is attached to the GPRS network. If the SGSN Address field is empty said wireless terminal is not attached to the GPRS network.
25

Having determined whether said wireless terminal MS is attached to the GPRS network, the HLR sends a PDU Info Response message 44, 44' to the default-GGSN, which sends either a positive or negative Client Identification Response message 47 to the MMSC. The positive Client Identification Response message
30   47 indicates that the wireless terminal having the MMS-ID in question is attached to the GPRS network and is, therefore, ready to receive the notification messages as a short message. The negative Client Identification Response message 47 indicates that said wireless terminal MS is not attached to the GPRS network, in which case it is not yet appropriate to send the notification message.
35

In addition to a GPRS network, the invention can also be implemented in 3rd generation networks, such as in a WCDMA network, because the uppermost protocol levels of such a network correspond to the uppermost protocol levels of a GPRS network. In a 3rd generation network, a 3G-GGSN (3rd Generation GGSN)

corresponds to the GGSN, a 3G-SGSN corresponds to the SGSN and a 3G-RAN (3rd Generation Radio Access Network) corresponds to the base station system BSS. According to one proposal, in a 3rd generation network, an IMUI (International Mobile User Identity) code corresponds terminologically to the IMSI code, and a UIM (User Identification Module) card corresponds to the SIM card.

The invention is also suitable for implementation in a WAP system. In this case, a WAP gateway is situated between the MMSC and the default-GGSN, through which messages travelling between the MMSC and the default-GGSN typically pass transparently.

The invention can be implemented in software by making the required changes to the program code in the GGSN. The functionality of the MMSC can also be implemented programmably. The computer program products in question can be stored in a data medium, for example, in a memory, they can be transferred and they can be executed, for example, in a computer.

Figure 5 shows a block diagram illustrating the functional blocks of an MMSC associated with implementation of the present invention. The MMSC comprises a GPRS interface 51 through which the MMSC communicates with a GGSN of a GPRS network. Communication with other external networks, such as the Inernet, is mangaed through an external interface 52 and communication with other multimedia messaging service centres is handled through an MMSC interface 53. Data store 54 is a database in which multimedia messages are stored and kept. A control unit 55 controls the operation of the MMSC. For mapping the plain (RFC822 address) of the recipient of a multimedia message to the correct MMS-ID, the MMSC comprises a database 56, in which the correspondences between the plain addresses in RFC822 format and the MMS-IDs are maintained. Additionally, the MMSC comprises some blocks related to authentication and maintenance of the MMSC (these are not shown in the figure).

According to the invention, multimedia messages addressed to a wireless terminal MS arrive at the MMSC via one of its interfaces (51 – 53) and are stored in the data store 54. On the basis of the data in database 56, the control unit maps the plain address of the wireless terminal MS (e.g. an address in RFC822 format) into an MMS-ID. The database 56 can be maintained, for example, by a telecommunication network operator or a service provider external to the cellular network. A new MMS-ID can be added to said database 56, for example, as follows: When the owner of a specific wireless terminal MS subscribes to a

multimedia messaging service, he / she tells the service provider the addresses of
the wireless terminal MS he / she uses (e.g. telephone number, electronic mail-
type address). The multimedia messaging service provider then agrees a suitable
value for the MMS-ID by which the wireless terminal will be unequivocally
5 identified with the GPRS operator question. Said addresses of the wireless
terminal and the corresponding MMS-ID are stored in the database 56 of the
MMSC. Correspondingly, the same MMS-ID is stored in a DNS server in the
GPRS network under the control of the operator and is associated with the IMSI
code that corresponds to the addresses in question. The inquiries (Client
10 Identification Request) sent to the GGSN are preferably generated at the GPRS
interface 51 at the command of the control unit 55, and its transmission takes
place via the GPRS interface 51. The GPRS interface 51 and the MMSC interface
66 of the GGSN, presented in connection with the description of Figure 6, together
implement the interface 22. The response to the inquiry (Client Identification
15 Response) sent by the GGSN is also received through the GPRS interface 51.
The interface (51 –53) of the MMSC through which multimedia messages are
subsequently transmitted in to the wireless terminal MS may vary depending on
the location of the MMSC and the wireless terminal.

20 Figure 6 shows a block diagram illustrating the functional blocks of a GGSN
associated with implementation of the present invention. The GGSN comprises an
SGSN interface 61 through which the GGSN communicates with the cellular.
network managed by its own operator (Intra-PLMN Backbone network). The
GGSN communicates with an HLR through an HLR interface 62. It is also possible
25 to communicate with other elements of a signalling network (e.g. SS7) through this
interface. The GGSN communicates with IP networks (e.g. the Internet) through
an IP interface 63 and with an X-25 packet network through an X.25 interface 64.
The GGSN transmits messages to the GPRS interface 51 of the MMSC and
receives messages from the GPRS interface 51 of the MMSC, in a manner
30 according to the invention, through an MMSC interface 66. The MMSC interface
66 and the GPRS interface 51 of the MMSC together implement the interface 22.

A routing function 65 routes data packets within the network managed by the
operator and between the network managed by the operator and other networks.
35 The DNS server is a separate device, typically controlled by the same operator as
the GGSN. The GGSN control unit 67, which controls the operation of the GGSN,
has a connection 69 to the DNS server. The DNS server contains information on
the correspondence of the MMS-IDs and the IMSI codes of wireless terminals.
Typically, the control unit 67 maps an MMS-ID arriving from the MMSC with a

Client Identification Request message 41 to the correct IMSI code, in a manner according to the invention, by inquiring about the IMSI code the corresponds to said MMS-ID from the DNS server over said connection 69.

5 According to the present invention, an identifier external to a cellular network is used to identify a wireless terminal MS, such as an MMS-ID, which identifies the wireless terminal MS in question unequivocally, independent of the wireless terminal's address in RFC822 format used at any given time. Thus, the IMSI code used to unequivocally identify the wireless terminal inside the cellular network
10 does not have to be revealed to outside the cellular network. Furthermore, use of an MMS-ID provides the advantage that if the address of the wireless terminal in RFC822 format changes, no changes are required in the cellular network (GPRS network). It is sufficient to update a new RFC822 address in the messaging server to correspond to the MMS-ID of the wireless terminal, which can still be used in
15 communication between the messaging server and the cellular network.

The invention also enables inquiries relating to a wireless terminal to be performed from outside a cellular network in connection with the use of dynamic PDP addresses, because an MMS-ID independent of the dynamic PDP address is
20 used in communication between the messaging server and the cellular network. Said inquiries are, for example, an inquiry to determine the readiness of a wireless terminal to receive data and an inquiry to determine whether a wireless terminal is attached to a GPRS network (i.e. an inquiry determine the readiness to receive a short message).
25

This description presents the implementation and embodiments of the present invention, with the aid of examples. It will be apparent to a person skilled in the art that the present invention is not restricted to details of the embodiments presented above, and that the invention can also be implemented in another form without
30 deviating from the characteristics of the invention. The embodiments presented above should be considered illustrative, but not restrictive. Thus, the possibilities for implementing and using the invention are only restricted by the accompanying claims. Consequently, the various options for implementing the invention as determined by the claims, including equivalent implementations, also belong to the
35 scope of the invention.